7 The Conservation Framework

Introduction

As expressed in the *Coconino County Comprehensive Plan's* vision statement, we desire thriving communities and viable economies that exist in harmony with our unique natural environment. The **CONSERVATION FRAMEWORK** explains why and how conservation-based planning can help achieve this goal. Developed with assistance of an independent Science Advisory Group, this framework provides the context for the plan's **GOALS** and **POLICIES** by detailing relevant scientific **PRINCIPLES** and **GUIDELINES** and explaining their importance to the planning process. By more fully integrating **CONSERVATION** and **DEVELOPMENT**, the *Comprehensive Plan* seeks to ensure that planning decisions meet human needs while maintaining the county's ecological integrity. This Conservation Framework can help developers and residents understand the criteria County planners use in reviewing proposed development projects.

IN THE CONSERVATION FRAMEWORK

Coconino County features some of the most spectacular **LANDSCAPES** and diverse environments in the Southwest. Its canyons, mountains, forests, **WOODLANDS**, grasslands, and vast **OPEN SPACES** support an incredible range of **ECOSYSTEMS**. These ecosystems contain all the **SPECIES** and **HABITATS** in a given area that interact together with the physical environment to form interdependent natural communities. The species that live here, the habitats they live in, and the complex **ECOLOGICAL PROCESSES** that guide their interactions have developed over thousands of years. They are unique to this area. Sustaining our ecosystems and the processes that maintain them is essential to our communities. In fact, a significant part of our economic activity ultimately depends on the health of these ecosystems—their flowing **SPRINGS** and rivers, clean water, dramatic landscapes, and abundant wildlife.

The principles and guidelines in this framework are based on the premise that humans are integral components of the ecosystem and that we play a crucial role in shaping our environments. Since we are a part of nature and our actions affect the health and vitality of ecosystems, we are responsible for proper **STEWARDSHIP** of **NATURAL AREAS**. Although all species seek food, water, and shelter, humans have the propensity to degrade or destroy entire ecosystems in our quest to achieve desirable standards of living. However, humans also have the ability to understand these ecosystems through science and to apply this understanding to protect the natural world. Ultimately, humans reap the rewards of conservation actions. Only by understanding science-based principles and applying the *CONSERVATION GUIDELINES* can we succeed in creating vibrant, fulfilling human communities that coexist with healthy, productive, natural ecosystems.

Benefits of Conservation-Based Planning

SEE ALSO PAGE 1
The Land Ethic

CONSERVATION-based planning provides an equitable way to consider the varied interests of residents, developers, and conservationists in a cooperative manner. It also allows us to create better, more livable communities. Applying conservation-based design concepts to development projects not only makes them more compatible with the *Comprehensive Plan*, but it can also make them more successful and attractive to buyers. Studies show that resale values are about 13 percent higher in conservation-based subdivisions than conventional ones.[11] Home buyers are willing to pay more for parcels located adjacent to dedicated **OPEN SPACE**, an important feature of conservation-based development. Providing open space helps protect or improve wildlife **HABITAT**, preserves water resources, and maintains forest health. Perhaps most importantly, when conservation planning is comprehensive in scope, it provides significant environmental, social, recreational, and economic benefits to residents, property owners, real estate professionals, and developers.[12] Conservation-based design methods allow us to meet market needs for quality **SUBDIVISIONS** without incurring additional public expenses or affecting our ability to maximize a property's use. These methods offer developers and landowners a way to capitalize on amenities such as riparian or **WETLAND** buffers, wildlife habitat, and open space.

SEE ALSO PAGE 20
Integrated Conservation Design

An important goal of this *Comprehensive Plan* is to give developers and landowners a higher level of predictability. This benefits them by providing the information they need to proactively address issues that could otherwise be time-consuming and costly to resolve. By consulting with County planners and decision-makers before designing new subdivisions, developers can make the review process significantly easier and less risky. This collaborative approach to conservation-based planning ultimately drives our desired development patterns for Coconino County.

Perhaps the greatest ultimate benefactor of conservation-based planning is the general public. Not only will their tax dollars be spent more wisely, but they will also benefit from amenities such as **TRAILS** and bike paths. Conservation-based design substantially reduces the costs associated with long-term infrastructure maintenance and **MITIGATION** measures—especially in **ENVIRONMENTALLY SENSITIVE LANDS**—by leaving more of the site in its natural state. A study by the Urban Land Institute concluded that the cost of roadway improvements for conservation-based developments would be about half the cost for conventional developments.[13] Many similar studies support this conclusion. Likewise, maintaining natural vegetation and topography can minimize flooding and **EROSION**, filter **POLLUTANTS** from stormwater **RUNOFF**, and allow runoff to **PERCOLATE** into the soil and replenish underlying **GROUNDWATER** supplies.

MITIGATION

The act of eliminating, reducing, minimizing, or compensating for an impact to the environment using measures that directly or indirectly reduce the impact. Applicants must attempt mitigative actions in the following order: (1) avoid impacts by not taking part or all of a certain action; (2) minimize impacts by limiting the degree or magnitude of the action; (3) rectify impacts by repairing, rehabilitating, or restoring the environment; and (4) compensate for unavoidable impacts by replacing or providing substitute resources or environments.

Conservation-based planning also supports our desire for quality neighborhoods where residents can meet, enjoy our unique **LANDSCAPE**, and see wildflowers, animals, and open spaces. Many national studies cite the availability of pedestrian and bike paths as a top criterion of new home buyers.[14] By looking beyond the boundaries of a single parcel, conservation-based development can unite a community with a system of **GREENWAYS**, trails, and protected natural lands. It can also help ensure that ecologically sensitive areas such as wetlands and **FLOODPLAINS** remain connected to adjacent **RIPARIAN AREAS** and stream corridors. This approach not only offers recreational opportunities and neighborhood amenities, but also maintain habitats and **WILDLIFE MOVEMENT CORRIDORS**.

Overwhelmingly, residents are attracted to Coconino County because of its unique natural environment. Changes to our surroundings need not destroy **HABITAT CONNECTIVITY** or natural communities. Conservation-based planning seeks to protect—and, where possible, to improve and restore—the **ECOSYSTEMS** that we share. To achieve this goal, the goals and policies of this *Comprehensive Plan* are based on a system of science-based ecological principles and CONSERVATION GUIDELINES.

Ecological Principles

BIOLOGICAL DIVERSITY (or "biodiversity")—the richness and complexity of life in a given area—is a cornerstone of healthy, vibrant **ECOSYSTEMS** that have the ability to recover from **DISTURBANCES**. Ecosystems respond to land use decisions and to climate fluctuations, which profoundly affect fire cycles, temperatures, and precipitation patterns and amounts. Making land use decisions that protect biodiversity at the genetic, species, habitat, and ecosystem levels is critical to ensuring that our **LANDSCAPES** can adapt to environmental changes.

ECOSYSTEM

The naturally interacting community of plant and animal species and their physical environment.

LANDSCAPE

The unique patterns, structures, and features such as landforms, vegetation, soil, and waterways that distinguish one part of the earth's surface from another.

Changes to an ecosystem can reach a critical point where they cause dramatic reductions in **SPECIES** populations or shifts from one biological community to another over a very short period. This **THRESHOLD** response is the point at which the habitat loses its ability to support species populations at optimum levels. Abrupt declines in populations may be difficult to predict because problems may not be evident until a key threshold is reached or exceeded. Threshold responses can be caused by human-triggered events such as **POLLUTION**; **HABITAT FRAGMENTATION**, conversion, or loss; and overuse of land and water resources. Exercising caution in land use decisions is important because approaching thresholds are not always apparent—nor are their triggers.

Five basic scientific **PRINCIPLES** summarize the essential aspects of healthy, functioning ecosystems: the *Time Principle*, the *Species Principle*, the *Unique Place Principle*, the *Ecological Processes Principle*, and the *Landscape Principle*. These principles, which are detailed below, have been adapted from research by the Ecological Society of America.[15]

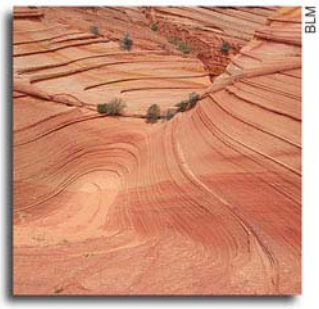
The Time Principle


John Aber

Today's species, habitats, and ecosystems developed over thousands of years; therefore, future species, habitats, and ecosystems will be influenced by decisions we make today. Because the full ecological consequences of decisions we make now may not manifest for many years, our land use decisions must consider potential long-term impacts.

The Species Principle

Because species have specific roles in an ecosystem, they can help us understand its function and health. Species are connected through such processes as predation, competition, and pollination. Native species are organisms that have evolved in a particular place as part of an ecosystem. Non-native or exotic species have evolved in other ecosystems and have been introduced here deliberately or accidentally. They can wreak havoc on native ecosystems by disrupting the delicate balance of native species or by spreading diseases.


BLM

The Unique Place Principle

Ecosystems, habitats, and species evolve in a specific place. Not only is their evolution related to local climatic, geologic, and hydrologic conditions, but it is heavily influenced by species interactions and natural processes. These factors create distinctive landscapes that are visually recognizable and have unique qualities and conditions—for example, the Colorado Plateau differs distinctly from the Sonoran Desert. Understanding the natural patterns within ecosystems and habitats is critical to the long-term, ecologically sound use of land.

The Ecological Processes Principle

Natural **ECOLOGICAL PROCESSES**—biotic, physical, disturbance, and cultural—help determine how an ecosystem functions. Biotic processes include the conversion of solar energy into plant material, physical processes include the infiltration of rainwater to underground **AQUIFERS**, and disturbance processes include natural wildfires and floods. Cultural

processes, on the other hand, involve human manipulation of the environment for human benefit, such as managing game species.

The Landscape Principle

Ecosystems occur within landscapes and interact in varying ways depending on their size, shape, and location. Consequently, the landscape context is important to the interactions, connectivity, and diversity of habitats and species. Larger habitats generally support a greater diversity of species than smaller habitats of the same type. Significant increases in the distance between habitats can alter or destroy interactions and cause species loss. Connectivity between habitats is considered a threshold dynamic—that is, gradual changes typically have gradual effects until a certain threshold is passed. At that point, effects are dramatic and may be irreversible.


John Aber

Guidelines for Decision Making

The following CONSERVATION GUIDELINES, which are adapted from research by the Ecological Society of America,[16] link **CONSERVATION** science and **LAND USE** planning. They form the basis of the **GOALS** and **POLICIES** that appear in each **ELEMENT** of the *Comprehensive Plan*—in fact, many of the plan's policies contain specific references to relevant CONSERVATION GUIDELINES, and almost every policy relates to one of the guidelines. For some Elements—Land Use and Growth, in particular—all eleven guidelines apply because their policies address the broadest possible spectrum of planning issues and land use decisions. For the Public Safety Element, which mainly addresses the County's role in providing safety services, only a few guidelines apply because these services typically do not impact natural resources. Some natural resources, such as water, are more subject to cumulative impacts (which CONSERVATION GUIDELINE K covers), while others, such as **ENVIRONMENTALLY SENSITIVE LANDS**, are subject to **HABITAT FRAGMENTATION** (covered by CONSERVATION GUIDELINE E).

The County's role in implementing the *Comprehensive Plan* involves applying CONSERVATION GUIDELINES A through K to land use decisions, particularly when evaluating the anticipated impacts of proposed developments. While each site and situation requires a unique planning approach, these guidelines offer us a predictable, systematic means to enhancing our environment (both natural and built) and avoiding, minimizing, or mitigating the negative impacts of development. These guidelines are especially useful to County planners when conducting preliminary assessments for proposed projects.

A. Assess impacts of local decisions in a landscape context.

Although land use planning occurs at the **LANDSCAPE** level, decisions are often made at the site level. However, because ecosystems and **HABITATS** are dynamic and interactive, land use changes often have effects beyond the boundaries of a site. Using the best available scientific information in making land use decisions will help ensure that the cumulative effects of human use do not compromise the landscape.

B. Make land use decisions that are compatible with the natural potential of the site and the landscape.

Land uses should consider the physical, biological, cultural, aesthetic, and economic constraints of the site and the landscape. Uses that are compatible with the site's "natural potential"—its water, vegetation, and soil resources—are usually cost-effective in the long term. Incompatible uses, on the other hand, often destroy habitat or degrade re-

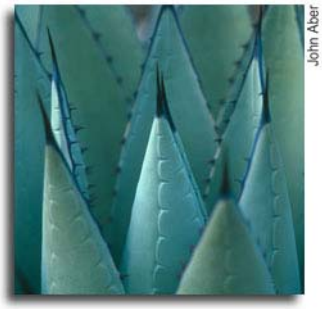
sources, ultimately resulting in higher costs. An example of a common but incompatible use is supplementing the natural resources of an area by adding nutrients through fertilization or adding water via irrigation.

C. Avoid or mitigate for the effects of human use and development on ecological processes and the landscape.

We can avoid, minimize, or mitigate the negative impacts of development by applying good planning and design principles at the appropriate scale. At a local scale, siting a structure without considering **ECOLOGICAL PROCESSES** may disrupt **WILDLIFE MOVEMENT CORRIDORS** or destroy a particular habitat. More regional impacts include changes to watershed processes caused by altering drainage patterns as part of a development project.

D. Identify and preserve rare or critical ecosystems, habitats, and associated species.

Rare or critical ecosystems support environmentally sensitive habitats and ecological processes that are key to the overall health and biological diversity of these ecosystems. To understand the factors that affect them, we must inventory critical components—vegetation and soil types, landforms, wildlife, and hydrologic and geologic features, among others. This information is required to make science-based land use decisions.


John Aber

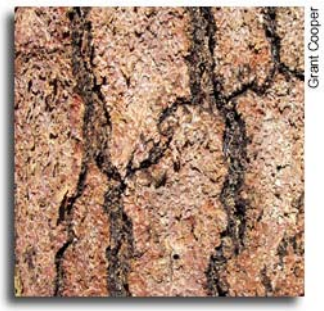
E. Minimize the fragmentation of large contiguous areas of habitat and maintain or restore connectivity among habitats.

Many ecosystem processes require large areas of unfragmented habitat. If this habitat is fragmented into smaller pieces or disconnected from the larger landscape, it can become threatened, jeopardizing the survival of **SPECIES**. Because some species require different habitats during different seasons, maintaining connectivity is important between different habitat types. In addition, because land management and political boundaries do not define habitats and ecosystems, coordination between planners and resource managers is critical.


John Aber

F. Minimize the introduction and spread of non-native species and use native plant species in restoration and landscaping.

Non-native organisms often have negative effects on native species, as well as on the structure and functioning of ecological systems. The cost of preventing their introduction and spread can be far less than the cost of restoring the long-term damage they can cause to aquatic and terrestrial ecosystems. Likewise, it can also be less than the cost of controlling non-native species after they become established.


Grant Cooper

G. Conserve use of non-renewable and critical resources.

To preserve the long-term health of our communities and economies, it is important to conserve critically important resources such as water and to reduce our reliance on non-renewable resources such as oil and gas.

H. Avoid land uses that deplete natural resources.

Reducing or depleting resources such as water, soil, wildlife, or natural vegetation alters ecosystems in significant and fundamental ways. Depleting these resources disrupts natural processes in ways that are often irreversible.

I. Avoid polluting our communities and environment.

Vibrant communities and ecosystems are either free of pollutants or they contain them at levels that are too low to disrupt natural processes. Land use decisions should limit the levels of **POLLUTION** entering our landscapes.

J. Consider land use decisions over time horizons that encapsulate the natural variability of ecosystems.

Because the factors affecting ecosystems vary, planning must consider the extreme and catastrophic events that occur over long periods. In the case of climate, such events would include floods, drought, and exceptionally high or low temperatures. For example, drought and flood cycles can differ in magnitude and time scale—El Niño/La Niña cycles occur every 7 to 10 years, Pacific Decadal Oscillations[17] occur every 30 to 50 years, tropical storms occur very erratically and infrequently, and long-term climate changes occur over hundreds to thousands of years. The recent return to drier conditions illustrates the importance of not over-committing an important natural resource (such as water) that all organisms need to survive.

K. Evaluate the effects of land use decisions cumulatively and over time.

Long-term changes caused by land use decisions can be delayed and cumulative. Impacts may not be apparent for years or decades; in some cases, we may not recognize them until they reach a **THRESHOLD** when impacts are dramatic. A series of seemingly innocuous, site-specific changes in land use can combine to produce cumulative effects that we cannot attribute to a single, landscape-scale event.

Limitations of Science


Grant Cooper

Although scientific knowledge is useful, it does not always provide clear, certain, and timely answers to important questions about potential environmental impacts. When certain activity threatens human health or the environment, precautionary measures should be taken regardless of whether all cause-and-effect relationships are fully established. This *Precautionary Principle*[18] recognizes that our understanding of ecosystems is complicated by many factors. Our overall goal is to prevent harm—not to prevent progress. In some instances, we must simply make a "no regrets" decision. In doing so, our decisions should be based not only on the best available scientific information, but also on sound professional judgment and open discussion of both the long-term advantages and consequences.

Ultimately, we need a decision-making framework that minimize risks to people and the environment. Likewise, we can also benefit from a conservation-based planning methodology. Although science cannot always provide definitive answers to land use and development decisions, we can—and should—commit to good planning, collaboration, and foresight. The **INTEGRATED CONSERVATION DESIGN** methods described below offer us an important set of tools for creating quality developments as communities continue to grow.

Integrated Conservation Design

INTEGRATED CONSERVATION DESIGN

A development concept that considers site characteristics and layout in the larger context of surrounding parcels. Integrated conservation design preserves important and unique natural features such as open space, viewsheds, scenic corridors, and wildlife habitat.

The *Comprehensive Plan* advocates a system of land use planning that reverses the trend of consumptive sprawl. The best methods for achieving this goal involve **INTEGRATED CONSERVATION DESIGN**, a conservation-based approach that offers a wide range of options for developments featuring large parcels of land. Integrated conservation design does not negate the rights of private property owners—it simply offers expanded, more flexible options for development.

Conventional Design Differences

Conservation-based planning differs from the "standard development grid" in two key ways. First, it offers protection for **ENVIRONMENTALLY SENSITIVE LANDS—WETLANDS, RIPARIAN AREAS**, steep slopes, and wildlife **HABITAT**. The value of such environmental amenities is evident from the high percentage (40 percent) of people who purchase golf-course lots

even though they don't play the game[19]; these buyers want the **OPEN SPACE** views associated with such properties. Second, conservation-based planning often integrates recreational amenities such as sports fields and playgrounds into new subdivisions, benefiting entire communities. Imagine a property featuring **FORESTLAND** and an open meadow that provides important wildlife habitat. Conventional development approaches advocate dividing it into individual lots and scattering houses throughout. Integrated conservation design, on the other hand, advocates tucking the houses into forested areas but leaving the meadow **UNDEVELOPED**. Likewise, if the property contains a wetland or **FLOODPLAIN**, conservation-based methods would place any buildings outside of these areas, leaving valuable habitat, open space, or other amenities that all property owners could enjoy.

The process for developing a property using integrated conservation design methods also differs from conventional development processes. In Coconino County, a parcel's **ZONING** determines its permitted density—that is, the number of units allowed "by right" within in a specified area. Developers and engineers typically begin the design process by drawing roads and lot lines on a map. In contrast, conservation-based planning advocates identifying environmentally sensitive areas *before* identifying the most suitable building sites based on factors such as the allowable density and the natural features of each parcel. The next design step entails aligning streets and **TRAILS**. The final step is drawing lot lines.

Options & Incentives

Integrated conservation design methods vary. One approach involves "clustering" development on portions of a property that are not environmentally sensitive and allowing the same net density that would be permitted with a conventional design. This approach not only reduces infrastructure costs, but it also lowers building costs, which are typically more expensive in areas such as floodplains and wetlands.

Another alternative is **TRANSFERRING DEVELOPMENT RIGHTS** to a portion of the property or to an entirely different property. Yet another design approach features dispersed clusters of home sites each with a designated "building envelope," or the space in which structures are permitted to be built. In this scenario, the land surrounding each site, plus all other undeveloped land, is held in common by all owners for conservation purposes. The home sites are strategically located to minimize impacts on the environment. Many other scenarios are possible; planners should work with property owners and developers to explore creative designs that best apply to a particular area or site.

Example Site Before Development

This example illustrates the design options for an 82 acre parcel. 20% of the site is naturally unbuildable because of wetlands and steep slopes.

Conventional Subdivision Development

Conventional development divides the total buildable portion of the site into equal-sized lots, providing no community open space and eliminating the possibility for habitat connectivity.

Graphics from *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*, by Randall G. Arendt. Copyright © 1996 by Island Press. Reproduced by permission of Island Press, Washington, D.C. and Covelo, California.

We also have many possible tools for encouraging the use of integrated conservation design in new subdivisions. One is amending ordinances so they no longer require a zone change when developers want to "cluster" units into a smaller area than what would be permitted under existing zoning. For example, consider a 100-acre parcel with a zoned minimum parcel size of 2½ acres for 40 lots. In this scenario, these 40 lots could be reduced to 1 acre in size and clustered together within an area that takes advantage of a major viewshed or other natural feature, leaving 60 acres of open space.

Density Bonus

An additional number of units or development capacity allowed in exchange for providing certain public benefits or amenities, such as parks, open space, or affordable housing.

Another approach for encouraging conservation design is to offer an incentive in the form of a **DENSITY BONUS** for including open space in a development. If 50 percent of our previous 100-acre example is set aside as open space (preferably for public access and use), perhaps the number of units could be increased by 20 percent; if this conservation set-aside covers 60 percent of the property, the density bonus could be increased to perhaps 40 percent. The details of such amendments would be worked out with resident input through the public hearing process that is requisite for all ordinance amendments.

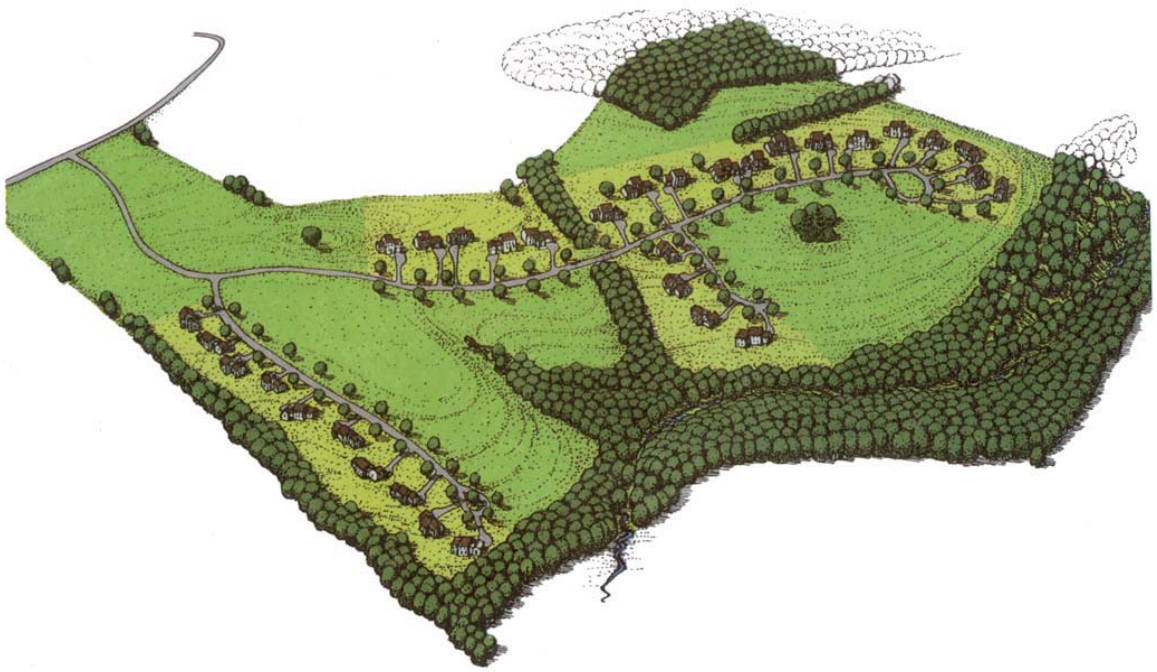
Conventional Development vs. Integrated Conservation Design

Integrated conservation design (right) accommodates the same amount of development as its conventional counterpart (left)—in this example 32 lots. The difference, however, is that the integrated conservation design provides that 65% of the site be dedicated to open space, a permanent amenity shared by all property owners. Conventional development gives each owner a 2 ½ acre parcel surrounded on all four sides by neighbors—integrated conservation design provides each resident uninterrupted views of the surrounding landscape and access to over 50 acres of land.

Design Applications

Integrated conservation design applies to a wide range of development projects, not just to low-density, high-end subdivisions. Two good examples of successful conservation design for moderately priced homes are found in Doney Park, where zoning density was increased to accommodate open space. Integrated conservation design could also work well for manufactured homes. Regardless of the type of development, integrated conservation design lets landowners maximize the use of their properties while offering the fundamental advantage of protecting a network of conservation and open space lands throughout the county.

Subdivision Development Using Integrated Conservation Design



The same 82 acre site with 32 homesites using integrated conservation design. Now with 50 acres of open space and connectivity of the regional ecosystems and habitats—a design that requires no additional cost to the developer yet provides substantial benefit to the owners, residents, and the environment.

Graphics from *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*, by Randall G. Arendt. Copyright © 1996 by Island Press. Reproduced by permission of Island Press, Washington, D.C. and Covelo, California.